VIESMANN

SCU224

Mounting
Connection
Handling
Fault indication
Examples

SCU224

US/CA

manual

49006430

Thanks for buying this product.
Read this manual carefully to get the best perfomance from this unit.

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Safety regulations:

Please read the following information carefully before installing and operating the controller. In this way damage to the solar system by wrong installation will be avoided. Please observe that the mounting is adapted to the characteristics of the building, that the local regulations are respected and is conform with the technical rules.

CU 72060171 01
UL 60730-1A:2002
CSA E60730.1:2002

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Editor: **Viessmann Manufacturing Company Inc.**.

Important notice:

We took a lot of care over the texts and drawings of this manual and to the best of our knowledge and consent. As faults can never be excluded, please note:
Your own calculations and plans under consideration of the current norms and DIN-directions should only be basis for your projects. We don´t offer a guarantee for the completeness of the drawings and texts of this manual - they only represent some examples. They can only be used on own risk. No liability is assumed for incorrect, incomplete or false information and the resulting damages.

Errors an technical changes excepted.

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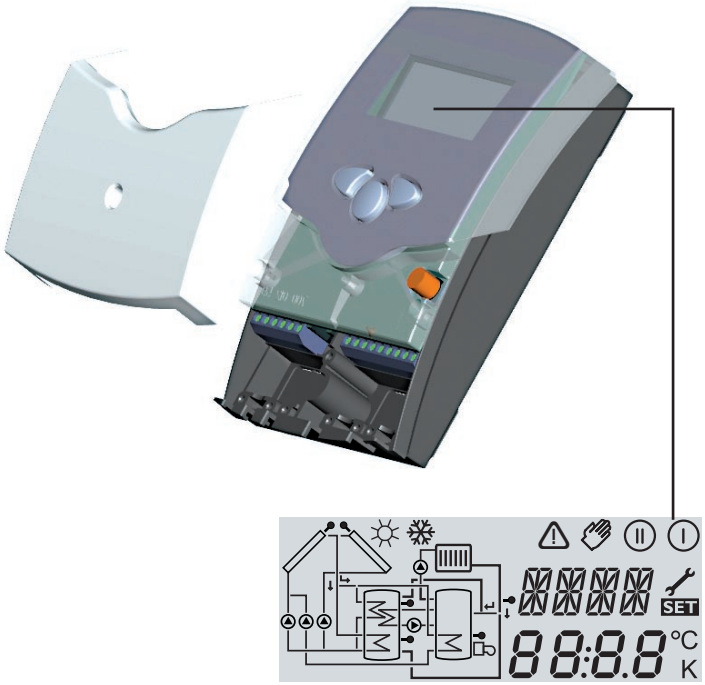
SCU224

- **System-monitoring-display**
- **Up to 4 temperature sensors Pt1000**
- **9 basic systems selectable**
- **Heat balancing**
- **VBus®**
- **Function control**
- **Thermostat function (time controlled)**
- **Parameterisation and control of the system by Service Center; Software is possible**
- **User-friendly operation by simple handling**
- **Housing in outstanding design and compact dimensions, easy to install**

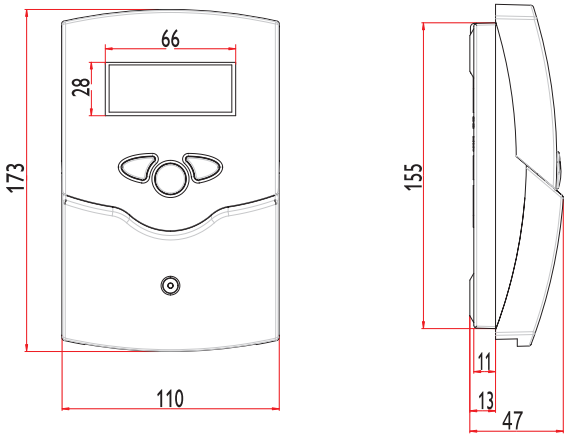


Scope of delivery:

1 x **SCU224**

1 x accessory bag
- 1 x spare fuse T4A
- 2 x screws and dowels
- 4 x strain relief and screws

Additionally enclosed in the full kit:
- 2 x sensor FKP6
- 2 x sensor FRP6



Technical data

Housing:
plastic, PC-ABS and PMMA

Protection type: IP 20 / DIN 40050

Ambient temp.: 32 ... 104 °F

Size: 172 x 110 x 46 mm

Mounting: wall mounting, mounting into patch-panels is possible

Display: System screen for system visualisation, 16-segment display, 7-segment display, 8 symbols for system status and operating control lamp

Operation: by 3 pushbuttons in the front of the housing

Functions: Differential temperature controller with optional add-on system functions. Operating hours counter for solar pump, tube collector special function, thermostat function and heat quantity balancing.

Inputs: for 4 temperature sensors Pt1000

Outputs: 2 electromechanical relays

Bus: VBus®

Power supply:
115V~

Total power supply:
4 (2) A 115V~

CE

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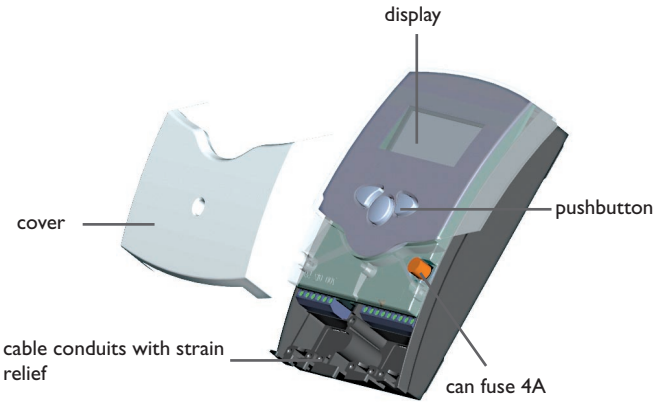
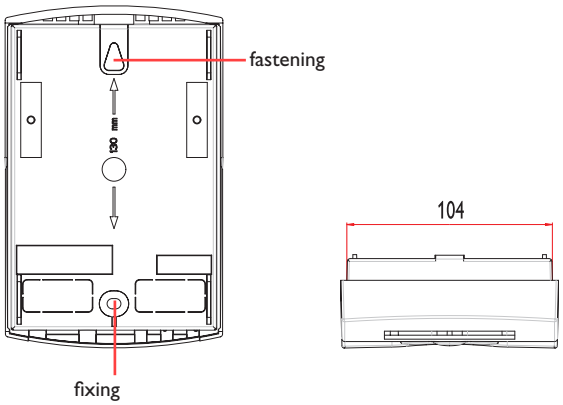
1. Installation

1.1 Mounting



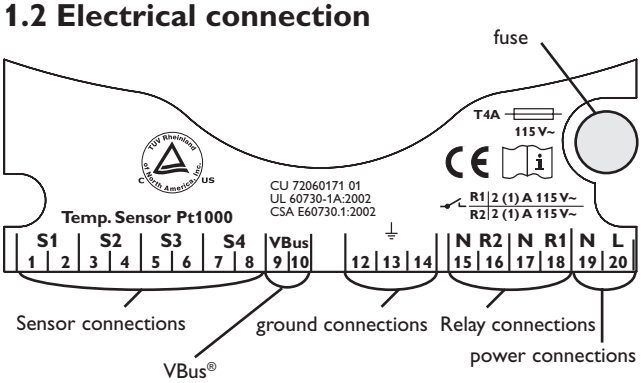


Warning!
Switch-off power supply before opening the housing.

The unit must only be located internally. It is not suitable for installation in hazardous locations and should not be sited near to any electromagnetic field.The controller must additionally be equipped with an all-polar gap of at least 3 mm or with a gap according to the valid installaton regulations, e.g. LS-switches or fuses. Please ensure sensor cables and AC power supply are separated.

1. Unscrew the cross-recessed screw of the cover and remove it from the housing.
2. Mark the upper fastening point on the wall and premount the enclosed plug and screw.
3. Hang up the housing at the upper fastening point and mark the lower fastening point on the subsurface (hole depth 1/2"). Install the plug in the lower hole.
4. Fasten the housing at the top and attach it with the lower fastening screw.

1.2 Electrical connection



Dangerous voltage on contact!

Electrostatic discharge can lead to damages of electronic components!

The power supply to the controller must only be made by an external power supply switch (last step of installation!) and the line voltage must be 115 Volt (60 Hz). Flexible lines are to be fixed at the housing by enclosed strain relief supports and screws.

The version the controller is equipped with 2 output relays to which the **consumers** e.g. pumps, valves etc. can be connected:

- Relay 1
  18 = line power conductor R1
  17 = neutral conductor N
  13 = ground clamp ⏚
- Relay 2
  16 = line power conductor R2
  15 = neutral conductor N
  14 = ground clamp ⏚

The **temperature sensors** (S1 up to S4) will be connected to the following terminals independently of the polarity:

1 / 2 = Sensor 1 (e.g. Sensor collector 1)
3 / 4 = Sensor 2 (e.g. Sensor tank 1)
5 / 6 = Sensor 3 (e.g. Sensor collector 2)
7 / 8 = Sensor 4 (e.g. Sensor tank 2)

The 115V power supply is connected to:

19 = neutral conductor N
20 = conductor L
12 = ground clamp ⏚

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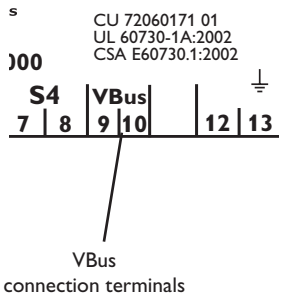
1.2.1 Data communication/ Bus



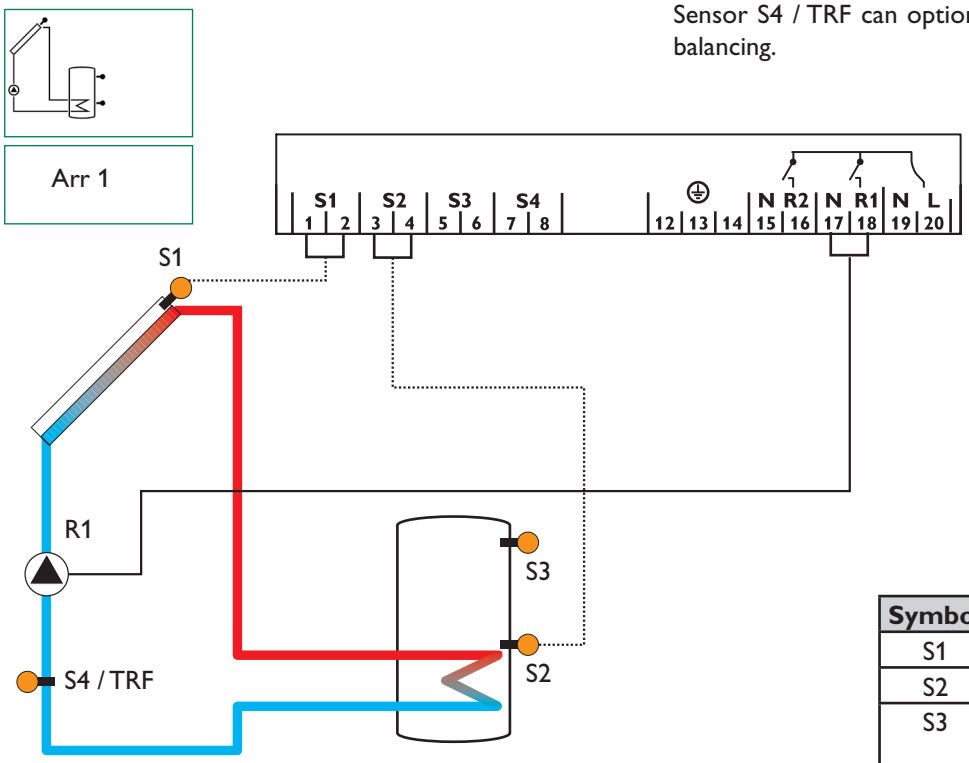
The controller comes with a VBus® for data communication and energy supply of external modules. The modules are connected independently of the polarity to the connections marked with „VBus®". Via this data Bus you can install one or more VBus® modules, e.g.:

- heat quant. measurement module WMZ
- large display GA3
- data logger, DL2
- smart Display SD3

Additionaly, the controller can be connected to the PC with the help of a USB Adaptor cable. With the **S**ervice **C**enter Software (RCS) the controller parameters can be changed, measurements can be read out, processed and visualised. The software enables an easy function control and adjustment of the system.

1.2.2 Wiring connections for system 1

Standard solar system with 1 tank, 1 pump and 3 sensors. Sensor S4 / TRF can optionally be used for heat quantity balancing.



Symbol	Specification
S1	Collector sensor
S2	Tank sensor below
S3	Tank sensor at the top (optionally)
S4 / TRF	Sensor for heat quantity measurement (optionally)
R1	Solar pump

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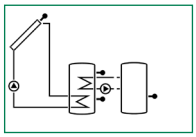
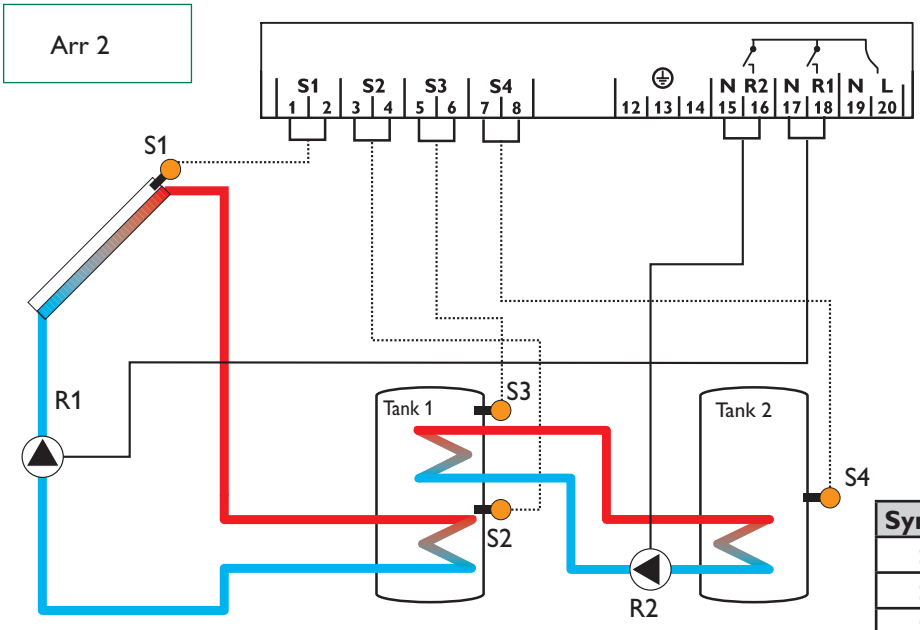
1.2.3 Wiring connections for system 2



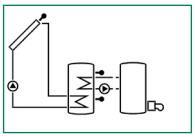
Arr 2

Solar system and heat exchange with an existing tank with 1 tank, 4 sensors and 2 pumps.



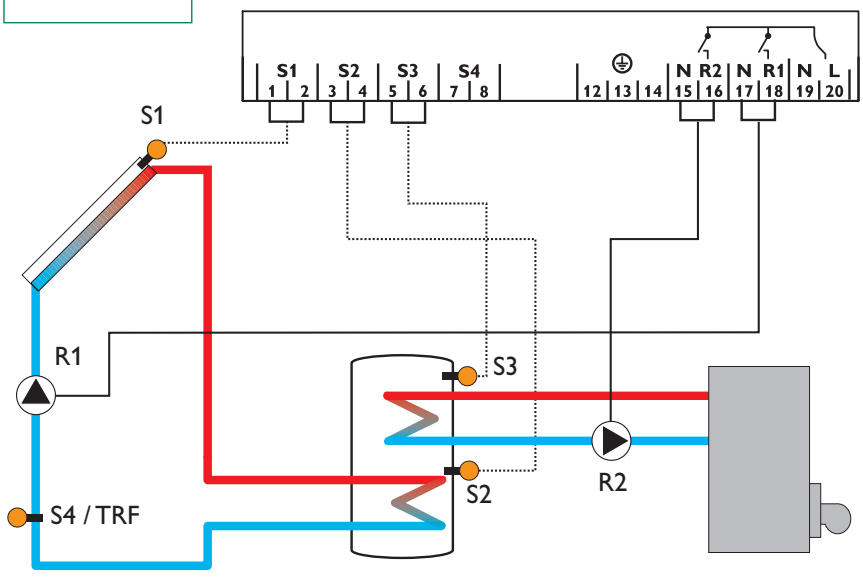
Symbol	Specification
S1	Collector sensor
S2	Tank sensor lower
S3	Tank sensor at the top
S4	Tank Sensor 2
R1	Solar pump
R2	Pump for heat exchange

1.2.4 Wiring connections for system 3



Arr 3

Solar system and after-heating with 1 tank, 3 sensors and after-heating. Sensor S4 / TRF can optionally be used for heat quantity balancing.



Symbol	Specification
S1	Collector sensor
S2	Tank sensor lower
S3	Tank sensor at the top
S4 / TRF	Sensor for heat quantity balancing (optional)
R1	Solar pump
R2	Pump for heat exchange

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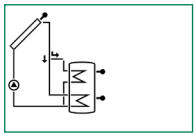
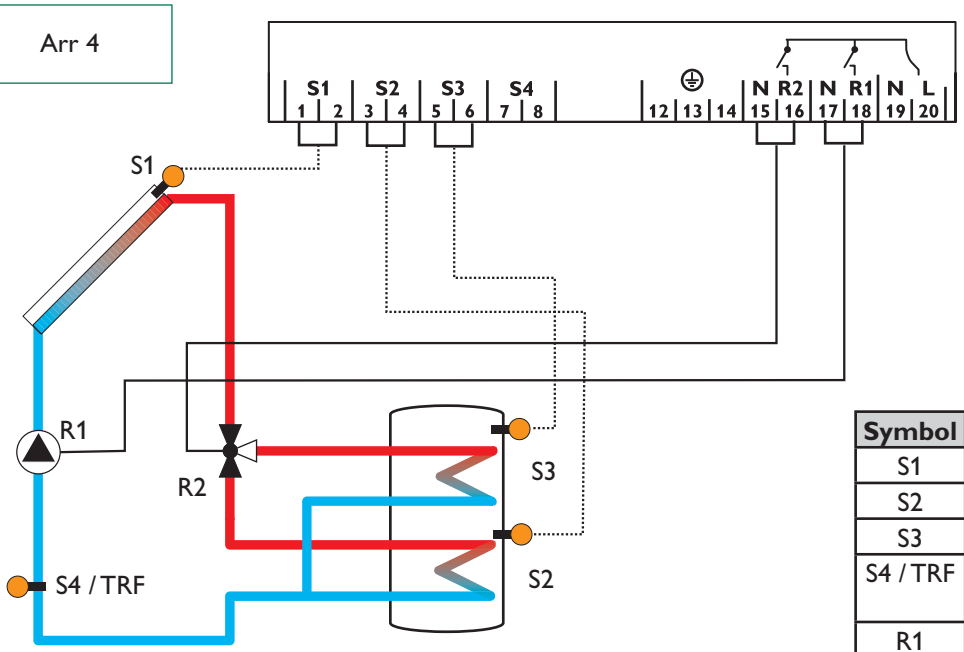
1.2.5 Wiring connections for system 4



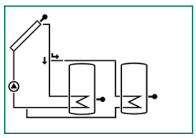
Arr 4

Solar system and tank charge in layers with 1 tank, 3 sensors, 1 solar pump and 3-way-valve for tank charge in layers. Sensor S4 / TRF can optionally be used for heat quantity balancing.



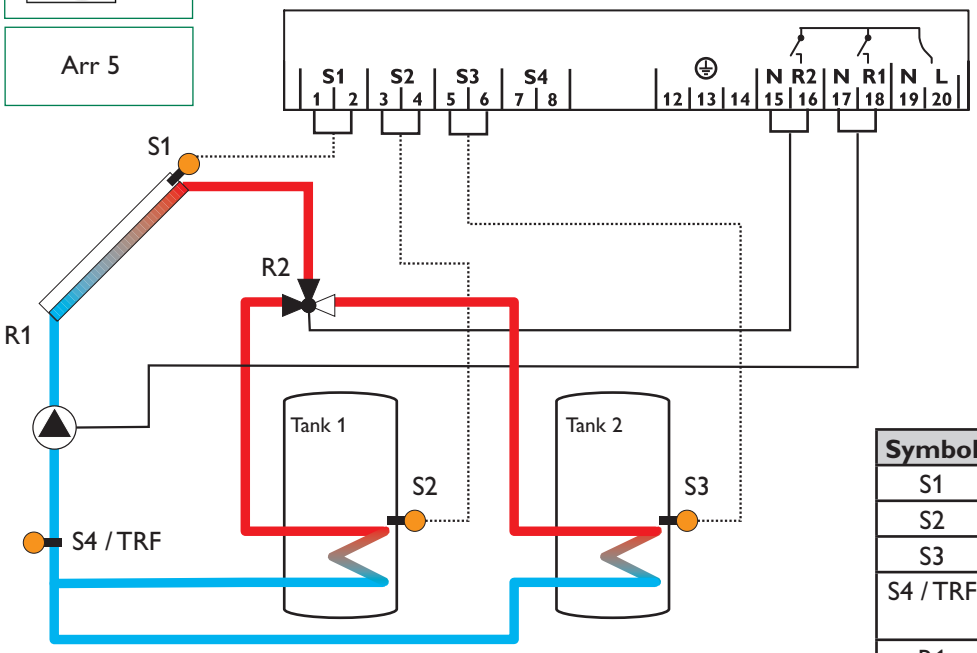
Symbol	Specification
S1	Collector sensor
S2	Tank sensor lower
S3	Tank sensor at the top
S4 / TRF	Sensor for heat quantity balancing (optionally)
R1	Solar pump
R2	3-way-valve

1.2.6 Wiring connections for system 5



Arr 5

2-tank-solar system with valve logic with 2 tanks, 3 sensors, 1 solar pump and 1 3-way-valve. Sensor S4 / TRF can optionally be used for heat quantity balancing.



Symbol	Specification
S1	Collector sensor
S2	Tank sensor 1
S3	Tank sensor 2
S4 / TRF	Sensor for heat quantity balancing (optionally)
R1	Solar pump
R2	3-way-valve

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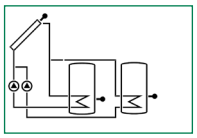
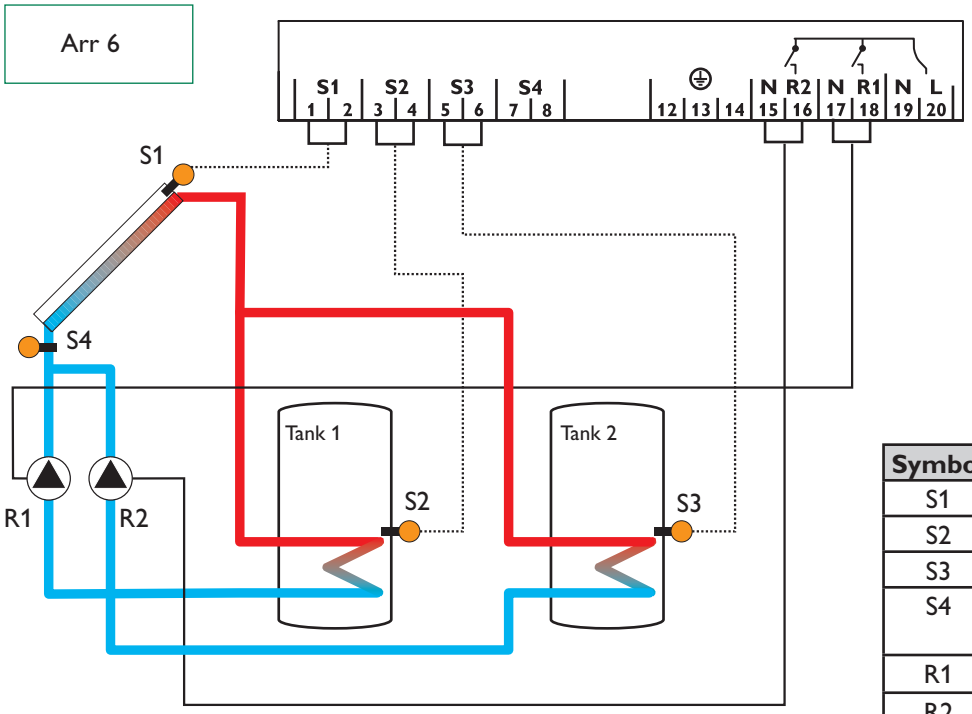
1.2.6 Wiring connections for system 6

2-tank-solar system with pump logic with 2 tanks, 3 sensors and 2 solar pumps.



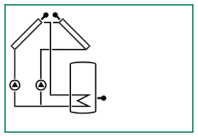
Arr 6



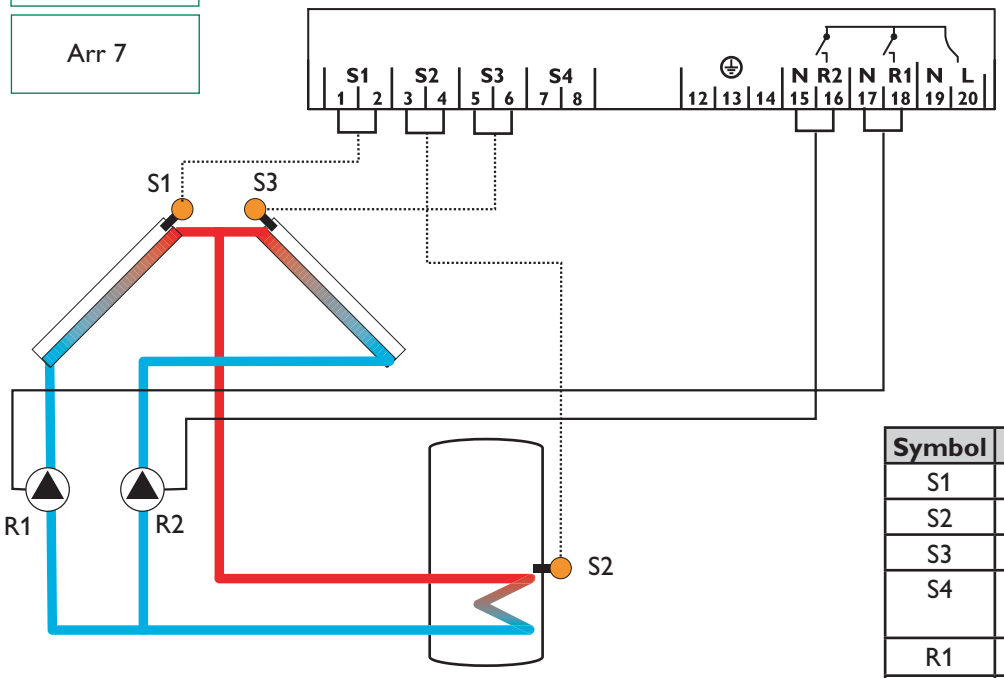
Symbol	Specification
S1	Collector sensor
S2	Tank sensor 1
S3	Tank sensor 2
S4	Measuring sensor (optional)
R1	Solar pump 1
R2	Solar pump 2

1.2.7Wiring connections for system 7

Solar system with east-west collectors, 1 tank, 3 sensors and 2 solar pumps.



Arr 7



Symbol	Specification
S1	Collector sensor
S2	Tank sensor 1
S3	Collector sensor 2
S4	Measuring sensor (optional)
R1	Solar pump collector 1
R2	Solar pump collector 2

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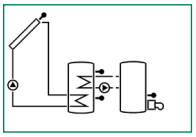
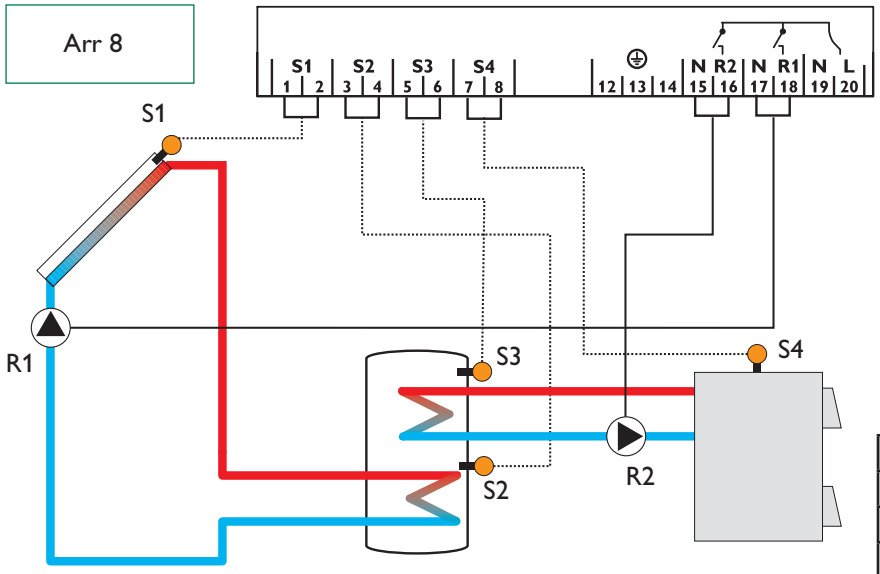
1.2.8 Wiring connections for system 8



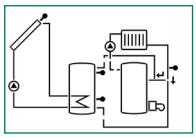
Arr 8

Solar system with after-heating by solid fuel boiler with 1 tank, 4 sensors, 1 solar pump and 1 pump for after-heating.



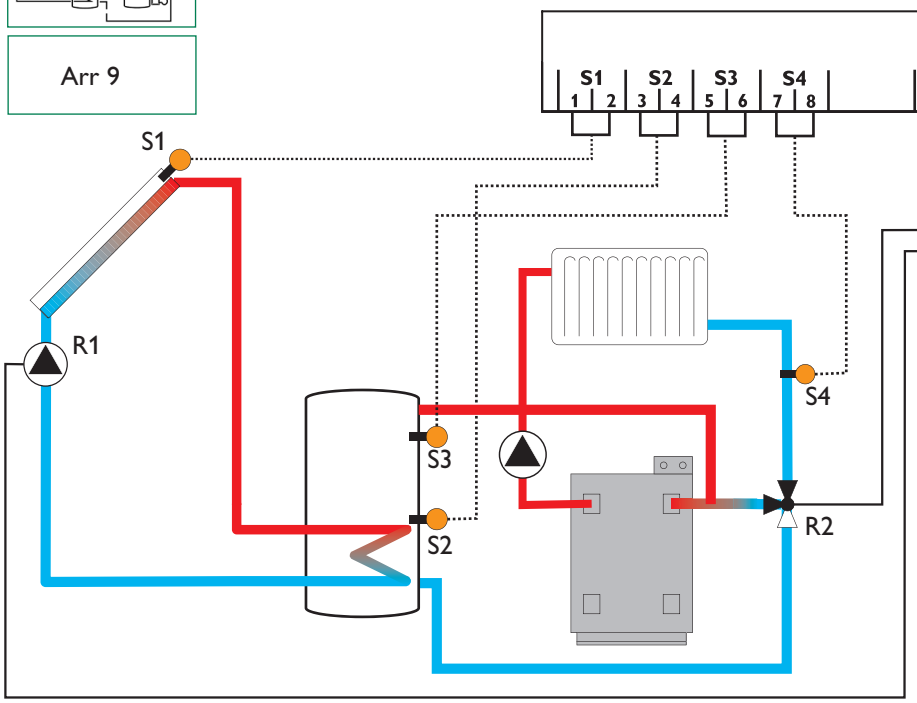
Symbol	Specification
S1	Collector sensor
S2	Lower tank sensor
S3	Upper tank sensor
S4	Tank for solid fuel boiler
R1	Solar pump
R2	Pump for solid hot fuel boiler

1.2.9 Wiring connections for system 9



Arr 9

Solar system and heating circuit reverse raising with 1 tank, 4 sensors, 1 solar pump and 1 3-way-valve for heating circuit reverse raising.



Symbol	Specification
S1	Collector sensor
S2	Lower tank sensor
S3	Upper tank sensor
S4	Heating circuit return
R1	Solar pump
R2	3-way-valve

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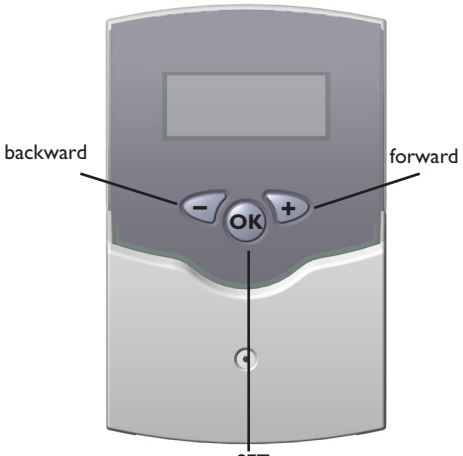
2. Operation and function

2.1 Pushbuttons for adjustment

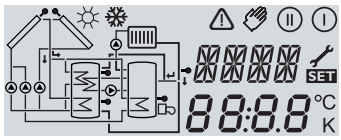


The controller is operated by 3 pushbuttons below the display. The forward-key (+) is used for scrolling forward through the indication menu or to increase the adjustment values. The backwards-key (–) is accordingly used for the reverse function.

For adjustment of last indication channel, keep button + pressed for 2 seconds. If an **adjustment value** is shown on the display, **SEt** is indicated. In this case you can press the key „Set“ (OK) in order to change into input mode.

Select a channel by keys – and +
Shortly press key OK, so that „SEt“ flashes
Adjust the value by keys – and +
Shortly press key OK, so that „SEt“ permanently appears, the adjusted value is now saved.

2.2 System monitoring display



Full Monitoring-Display

The system monitoring display consists of 3 blocks: **indication of the channel, tool bar** and **system screen** (active system scheme).

2.2.1 Channel indication

indication channel only

The **indication channel** consists of two lines. The upper line is an alphanumeric 16-segment indication in which mainly the channel names / menu items are shown. In the lower 7-segment indication, the channel values and the adjustment parameters are indicated.
Temperatures are either indicated in **°F** or **°C**, whereas temperature differences are indicated in **K** or **°Ra** respectively.

2.2.2 Tool bar

tool bar only

The additional symbols of the **tool bar** indicate the current system status.

Symbol	standard	blinking
⏻	relay 1 active	
⏸	relay 2 active	
☼	maximum tank limitation active / maximum tank temperature exceeded	collector cooling function or recooling function active
❄	antifreeze- function activated	collector minimum limitation or antifreeze function active
⚠		collector security shutdown or tank securtiy shutdown active
⚠ + 🔧		sensor defect
⚠ + ✋		manual operation active
SET		an adjustment channel is changed SET-mode

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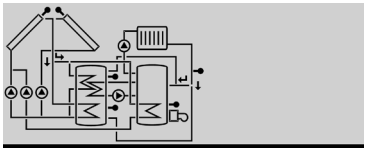
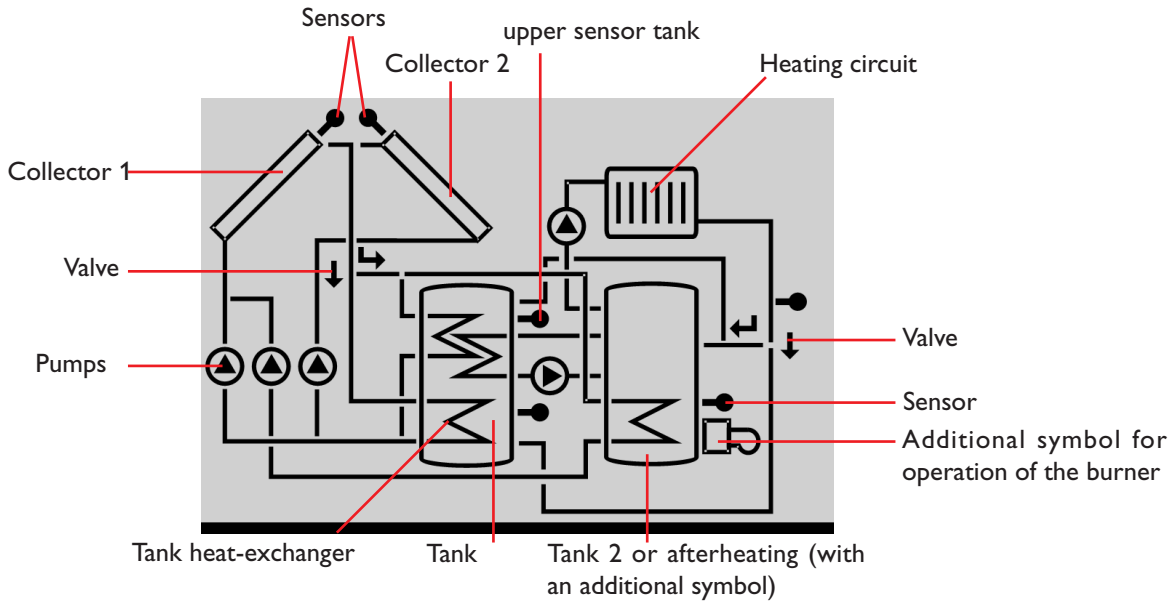
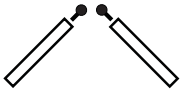
2.2.3 System screen



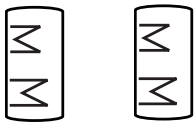
System Screen only

The system screen (active system scheme) shows the schemes selected on the controller. It consists of several system component symbols, which are - depending on the current status of the system - either flashing, permanently shown or hidden.





Collectors
with collector sensor



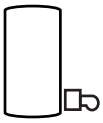
Tanks 1 and 2
with heat-exchanger

3-way-valve
The flow direction or the current breaking capacity is always shown.

Temperature sensor

Heating circuit

Pump



Afterheating
with burner symbol

2.3 Blinking codes

2.3.1 System screen blinking codes

- Pumps are blinking during starting phase
- Sensors are blinking if the respective sensor-indication channel is selected.
- Sensors are quickly blinking in case of sensor defect.
- Burner symbol is blinking if after-heating is activated

2.3.2 LED blinking codes

Constantly green:	everything all right
Red/green blinking:	initialisation phase manual operation
Red blinking:	sensor defect (sensor symbol is quickly blinking)

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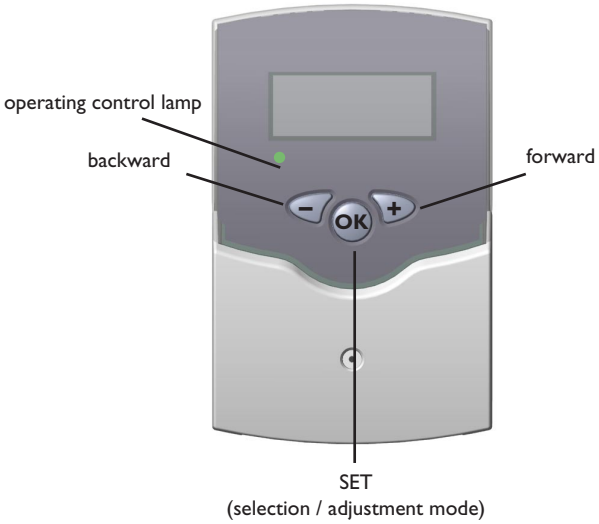
3. Primary commissioning

For primary commissioning the system configuration has to be adjusted first



1. AC power supply must be activated at first. The controller passes an initialisation phase during which the operating control lamp is blinking red and green. After having finished the initialisation, the controller is in automatic operation with factory settings. The factory default system configuration is Arr 1.

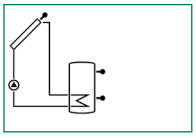
2. Clock time adjustment in channel TIME. By pressing the SET button once you can adjust hours, pressing it once again the minutes. The time can be adjusted by buttons + and - and saved by pressing the SET button.

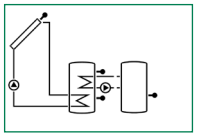
3. - select adjustment channel Arr

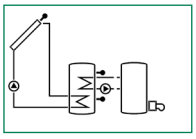
- change into SET-mode (see 2.1)

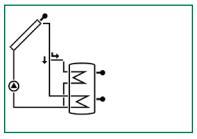
- adjustment are saved by pressing button SET

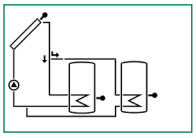
Now the controller is ready for operation and should enable an optimum operation of the solar system with the factory settings.

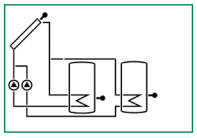

Arr 1

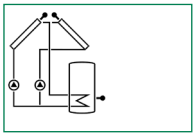

Arr 2

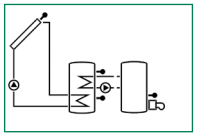

Arr 3

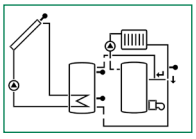

Arr 4


Arr 5


Arr 6


Arr 7


Arr 8


Arr 9

System configurations:

Arr 1 : standard solar system
Arr 2 : solar system with heat exchange
Arr 3 : solar system with after-heating
Arr 4 : solar system with tank charge in layers
Arr 5 : 2-tank solar system with valve logic
Arr 6 : 2-tank solar system with pump logic
Arr 7 : solar system with 2 collectors and 1 tank
Arr 8 : solar system with after-heating by solid hot fuel boilers
Arr 9 : solar system with heating circuit reverse raising

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4. Control parameter and indication channels

4.1 Channel-overview

Legend:

x

Corresponding channel is available.

x*

Corresponding channel is available if the appropriate option is activated.

Please note:
S3 and S4 are only indicated in case of sensors connected

①

Corresponding channel is only available if the option heat quantity measurement is **activated** (OHQM).

②

Corresponding channel is only available if the option heat quantity measurement is **deactivated** (OHQM).

MEDT

The channel antifreeze content (MED%) is only shown if **the antifreeze is not water or Tyfocor LS / G-LS (MEDT 0 or 3).** Adjustments concerning the antifreeze content will only make sense if the antifreeze is used in the solar circuit.

Channnel	Arr									Specification	Page
	1	2	3	4	5	6	7	8	9		
COL	x	x	x	x	x	x		x	x	Temperature collector 1	15
COL 1							x			Temperature collector 1	15
TST	x						x			Temperature tank 1	15
TSTU			x	x				x	x	Temperature tank 1 below	15
TST1		x			x	x				Temperature tank 1 below	15
TSTO		x	x	x				x	x	Temperature tank 1 at the top	15
TST2		x			x	x				Temperature tank 2 below	15
TFSB								x		Temperature solid hot fuel boiler	15
TRET									x	Temperature heating circuit	15
COL2							x			Temperature collector 2	15
S3	x									Temperature sensor 3	15
TRF	①		①							Temperature return sensor	15
S4	②		②	②	②	x	x			Temperature sensor 4	15
hP	x			x	x				x	Operating hours relay 1	16
h P1		x	x			x	x	x		Operating hours relay 1	16
h P2		x	x			x	x	x		Operating hours relay 2	16
kWh	①		①	①	①					Heat quantity kWh	16
MWh	①		①	①	①					Heat quantity MWh	16
time	x									Time	15
Arr	1-9									System	12
DT O	x	x	x				x	x	x	Switch-on temperature diff	17
DT1O				x	x	x				Switch-on temperature diff 1	17
DT F	x	x	x				x	x	x	Switch-off temperature diff 1	17
DT1F				x	x	x				Switch-off temperature difference	17
S MX	x	x	x				x	x	x	Maximum temperature tank 1	17
S1 MX				x	x	x				Maximum temperature tank 1	17
DT2O				x	x	x				Switch-on temperature difference 2	17
DT2F				x	x	x				Switch-off temperature difference 2	17
S2MX				x	x	x				Maximum temperature tank 2	17
EM	x	x	x	x	x	x		x	x	emergency temperature collector 1	18
EM1							x			emergency temperature collector 1	18

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Channel	Arr									Specification	Page
	1	2	3	4	5	6	7	8	9		
OCX	x	x	x	x	x	x		x	x	option collector cooling collector 1	18
OCX1							x			option collector cooling collector 1	18
CMX	x*	x*	x*	x*	x*	x*		x*	x*	maximum temperature collector 1	18
CMX1							x*			maximum temperature collector 1	18
OKN	x	x	x	x	x	x		x	x	option minimum limitation collector 1	18
OKN1							x			option minimum limitation collector 1	18
CMN	x*	x*	x*	x*	x*	x*		x*	x*	minimun temperature collector 1	18
CMN1							x*			minimun temperature collector 1	18
OCF	x	x	x	x	x	x		x	x	option antifreeze collector 1	18
OCF1							x			option antifreeze collector 1	18
CFR	x*	x*	x*	x*	x*	x*		x*	x*	antifreeze temperature collector 1	18
CFR1							x*			antifreeze temperature collector 1	18
EM2							x			emergency temperature collector 2	18
OCX2							x			option collector cooling collector 2	18
KMX2							x*			maximum temperature collector 2	18
OCN2							x			option miminum limitation collector 2	18
CMN2							x*			minium temperature collector 2	18
OCF2							x			option antifreeze collector 2	18
CFR2							x*			antifreeze temperature collector 2	18
PRIO				x	x	x				priority	19
tST				x	x	x				stop time	19
tRUN				x	x	x				Ciruclation time	19
OREC	x	x	x	x	x	x	x	x	x	option reccoling	19
OTC	x	x	x	x	x	x	x	x	x	option tube collector	19
DT3O		x						x		switch-on temperature difference 3	17
DT3F		x						x		switch-off temperature difference 3	17
MX3O		x						x		switch-on treshold for maximum temp.	17
MX3F		x						x		switch-off treshold for maximum temp.	17
MN3O		x						x		switch-on treshold for minimum temp.	17
MN3F		x						x		switch-off treshold for minimum temp.	17
AH O			x							switch-on temp. for thermostat 1	20
AH F			x							switch-off temp. for thermostat 1	20
OHQM	x		x	x	x					option WMZ	16
FMAX	①		①	①	①					maximum flow	16
MEDT	①		①	①	①					antifreeze type	16
MED%	MEDT		MEDT	MEDT	MEDT					antifreeze content	16
t1 on			x							Switch on time 1 thermostat	20
t1 off			x							Switch off time 1 thermostat	20
t2 on			x							Switch on time 2 thermostat	20
t2 off			x							Switch off time 2 thermostat	20
t3 on			x							Switch on time 3 thermostat	20
t3 off			x							Switch off time 3 thermostat	20
HND1	x	x	x	x	x	x	x	x	x	manual operation relay 1	20
HND2	x	x	x	x	x	x	x	x	x	manual operation relay 2	20
LANG	x	x	x	x	x	x	x	x	x	Language	20
UNIT	x	x	x	x	x	x	x	x	x	Change over °FAH / °CEL	20
PROG	XX.XX									program number	
VERS	X.XX									version number	

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4.1.1 Indication of collector temperatures

COL, COL1, COL2:
Collector temperature
display range: -40 ...+480°F

Shows the current collector temperature.

- COL : collector temperature (1-collector-system)
- COL1: collector temperature 1
- COL2: collector temperature 2

4.1.2 Indication of tank temperatures

TST, TSTL, TSTU, TST1, TST2:
Tank temperatures
Display range: -40 ...+480 °F

Shows the current tank temperature.

- TST : tank temperature (1-tank-system)
- TSTL : tank temperature lower
- TSTU : tank temperature above
- TST1 : temperature tank 1
- TST2 : temperature tank 2

4.1.3 Indication of sensor 3 and sensor 4

S3, S4:
S3, S4:
Sensor temperatures
Display range: -40 ...+480 °F

Shows the current temperature of the corresponding additional sensor (without control function).

- S3 : temperature sensor 3
- S4 : temperature sensor 4

Please note:
S3 and S4 are only shown if the temperature sensors are connected.

4.1.4 Indication of other temperatures

TFSB, TRET, TRF:
other measured temperatures
Display range: -40 ...+480 °F

Shows the current temperature of the corresponding sensor.

- TFSB : temperature solid fuel boiler
- TRET : temperature heating reverse raising
- TRF : temperature return flow

4.1.5 Time

In this channel the current time is indicated.
By pressing button SET (OK) for 2 seconds the hours, by pressing it again the minutes are displayed blinking. The time can be set by buttons + and - and saved by pressing the SET (OK) button.

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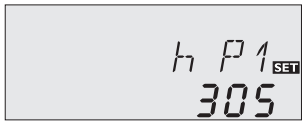
4.1.6 Operating hours counter

h P / h P1 / h P2:
operating hours counter
Indication channel



The operating hours counter adds up the solar operating hours of the respective relay (**h P / h P1** / **hP2**). Full hours are shown on the display.

The operating hours added up can be reset. As soon as one operating hours channel is selected, the symbol **SET** in permanently shown on the display. The button SET (OK) must pressed for approx. 2 seconds in order to get back into the RESET-mode of the counter. The display-symbol **SET** is flashing and the operating hours will be set to 0. In order to finish the RESET-procedure, the button SET (OK) must be pressed in order to confirm.

In order to interrupt the RESET-procedure, no button should be pressed for about 5 seconds. The controller returns automatically into the indicaton mode.

4.1.7 Heat quantity balancing

OHQM:Heat quantity measurement
Adjustment range: OFF ...ON
Factory setting: OFF

A heat quantity balancing is possible for the basic systems (Arr) 1, 3, 4 and 5 in conjunction with a flowmeter. You just have to activate the option heat quantity balancing in channel **OHQM.**

FMAX: Volume flow in l/min
Adjustment range 0 ... 20
in steps of 0,1
Factory setting 6,0

The volume flow readable at the flowmeter (l/min) must be adjusted in the channel **FMAX**. Antifreeze type and concentration of the heat transfer medium are indicated on channels **MEDT** and **MED%.**

MEDT: antifreeze
Adjustment range 0 ...3
Factory setting 1

Type of antifreeze:
0 : water
1 : propylene glycol
2 : ethylene glycol
3 : Tyfocor® LS / G-LS

MED%: Concentration of antifreeze in (Vol-) %
MED% is blinded out by MEDT 0 and 3.
Adjustement range 20 ...70
Factory setting 45

Note: When using Tyfocor HTL antifreeze set the Type to the 1 (propylene glycol), and set the concentration to 50%

kWh/MWh:Heat quantity in kWh / MWh
Display channel

The heat quantity transported is measured by the indication of the volume flow and the reference sensor of feed flow S1 and return flow S4. It is shown in kWh-parts in the indication channel **kWh** and in MWh-parts in the indication channel **MWh**. The sum of both channels form the total heat output.

The heat quantity added up can be reset. As soon as one of the display channels of the heat quantity is selected, the symbol **SET** is permanently shown on the display. The button SET (OK) must be pressed for approx. 2 seconds in order to get back into the RESET-mode of the counter. The display-symbol **SET** is flashing and the value for heat quantity will be set to 0. In order to finish the RESET-procedure, the button SET (OK) must be pressed for confirmation.

In order to interrupt the RESET-procedure, no button should be pressed for about 5 seconds. The controller returns automatically into indication mode.

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4.1.8 ΔT-regulation

DT O:
Switch-on temperature difference
Adjustment range
2,0 ... 40,0 °Ra
Factory setting 12.0

Primarily the controller looks at the temperature difference between the collector temperature sensor and the tank temperature sensor. If the switch-on temperature difference (**DT O** / **DT1O** / **DT2O**) is reached, the pump is activated. If the adjusted switch-off temperature is underrun (**DTF** / **DT1F** / **DT2F**), the controller switches-off.

DT F / **DT1F** / **DT2F** / **DT3F**:
Switch-off temperature difference
Adjustment range 1,0...38,0°Ra
Factory setting 8,0°Ra

Please note: Switch-on temperature difference DT O must be at least 2 °Ra higher than the switch-off temperature-difference DF.

4.1.9 Tank maximum temperature

S MX / **S1MX** / **S2MX**:
Maximum tank temp.
Adjustment range 40 ... 203 °F
Factory setting 140 °F

If the adjusted maximum tank temperature is exceeded, further heating of the tank is stopped so that damaging overheating can be avoided. If the maximum tank temperature is exceeded, the display will show the symbol ✷.

Please note: The controller is equipped with a security-switch-off of the tank, which avoids further heating of the tank if 203 °F is reached at the tank.

4.1.10 ΔT-controller (solid fuel boiler and heat exchange)

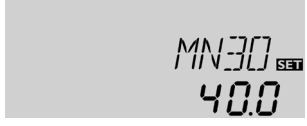
Maximum temperature limitation

MX3O / MX3F:
Maximum temperature limitation
Adjustment range 30...205°F
Factory setting
MX3O 140°F
MX3F 136°F

The controller is equipped with an independent temperature differential regulation for which minimum and maximum temperature limations as well as corresponding switch-on and -off temperatures can be separately adjusted. Only possible for Arr = 2 and 8 (e.g. for solid fuel boilers or heat exchange regulation).

If the adjusted value **MX3O** is exceeded, relay 2 will be deactivated. When falling below **MX3F**, the relay will be switched on again.
Reference sensor:
S3 by Arr 8 (TSTU)
S4 by Arr 2 (TST2)

Minimum temperature limitation
MN3O / MN3F:
Minimum temperature limitation
Adjustment range 30...195°F
Factory setting:
Arr = 2
MN3O 40°F
MN3F 50F
Arr = 8
MN3O 140°F
MN3F 150°F



Is the adjusted value **MN3O** underrun, relay 2 will be deactivated. By falling below **MN3F**, the relay will be switched on again.
Reference sensor:
S4 by Arr 8 (TFSB)
S3 by Arr 2 (TSTU)

Both switch on- and switch off temperature differences **DT3F** and **DT3O** apply parallely for the maximal- and minimal temperature limit.

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4.1.11 Collector temperature limitation Emergency shut down of the collector

EM / EM1 / EM2:
temperature limitation corector
Adjustment range 230...400°F
Factory setting 285°F

If the adjusted collector limit temperature (**EM** / **EM1** / **EM2**) is exceeded the solar pump (R1/R2) is deactivated in order to avoid a damaging overheating of the solar components (collector emergency shutdown). The factory setting for the temperature limitation is 285°F - it can be changed within the adjustment range of 230 ...400°F. Symbol ⚠ is shown on the display (blinking).

4.1.12 System cooling

OCX / OCX1 / OCX2:
Option System cooling
Adjustment range OFF...ON
Factory setting ON

CMX / CMX1 / CMX2:
collectormaximumtemperature
Adjustment range 210...380°F
Factory setting 250°F

If the adjusted maximum tank temperature is reached, the solar system switches-off. If now the collector temperature rises to the adjusted maximum collector temperature (**CMX** / **CMX1** / **CMX2**), the solar pump remains activated until this temperature limitation value is again underrun. The tank temperature might continue to rise (subordinated active maximum tank temperature), but only up to 203°F (emergency shutdown of the tank). If the tank temperature is higher than the maximum tank temperature (**S MX** / **S1MX** / **S2MX**) and the collector temperature is by at least 10°RA lower than the tank temperature, the solar pump is activated until the tank is cooled down again by the collector and the tubes below the adjusted maximum temperature (**S MX** / **S1MX** / **S2MX**)(only by activated **OREC** function).
In case of an activated system ☀ is shown on the display (blinking). Due to the cooling function, the solar system can be kept operable for a longer period on hot summer days and a thermal release of the collector and the heat transfer medium is ensured as well.

4.1.13 Option collector minimum limitation

OCN / OCN1 / OCN2:
collector minimum limitation
OFF / ON
Factory setting OFF

CMN / CMN1 / CMN2:
col. minimum temperature
Adjustment range 50...195°F
Factory setting 50°F

The minimum collector temperature is a minimum switching temperature which must be exceeded so that the solar pump (R1/R2) is switched-on. The minimum temperature shall avoid a steady starting-up of the solar pump (or solid fuel boiler charging pumps) for low collector temperatures.
If the minimum temperature is underrun, ❄ is shown on the display (blinking).

4.1.14 Option antifreeze

OCF / OCF1 / OCF2:
antifreeze function
Adjustment range OFF / ON
Factory setting OFF

CFR / CFR1 / CFR2:
antifreeze temperature
Adjustment range 15...50°F
Factory setting 40°F

The antifreeze function activates the loading circuit between collector and tank if the adjusted antifreeze function is underrun in order to protect the medium against freezing or „thickening". If the adjusted frost protection temperature is exceeded by 2°F, the loading circuit will be deactivated.

Please note:
As there is only a limited quantity of heat available in the tank for this function, the antifreeze function should only be used in regions with few days of temperatures around freezing point.

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4.1.15 Oscillating charge

Respective adjustment values:

	Factory setting	Adjustment range
priority [PRIO]	(1 / Arr 5,6) (2 / Arr 4)	0-2
oscillating break-time [tST]	2 min.	1-30 min.
oscillating charge-time [tRUN]	15 min.	1-30 min.

The SCU224 priority logic

priority:

The above-mentioned options and parameters only have a meaning in multi-tank systems (system Arr = 4, 5, 6). If **priority 0** is adjusted, the tanks which show a temperature difference towards the collector are loaded in numerical order (tank 1 or tank 2). Usually only one tank is loaded at this point. For Arr= 5, 6 parallel loading is also possible.

Oscillating break time / oscillating charge time / collector rising temperature

The controller checks the tanks regarding loading facilities (switch-on difference). If the priority tank cannot be loaded, the lower-ranking tank is checked. If the lower-ranking tank can be charged this is effected by the so-called „oscilating charge time“ (**tRUN**).When the oscillating charge time is over the loading is stopped. The controller regulates the increase of the collector temperature. If it increases by the collector rising temperature (ΔT-Col 4°Ra, fixed software value), the expired break time is again reset to zero and the oscillating break time starts again. If the switch-on conditions of the priority tank are not reached, the loading of the lower-ranking tank is continued. If the priority switch has reached its maximum temperature, the oscillating charge is not effected.

4.1.16 Recooling function

OREC:
option recooling
adjustment rangeOFF...ON
Factory setting: OFF

If the adjustem maximum tank temperaute (**S MX, S1MX, S2MX**) is reached, the solar pump remains activated in order to avoid an overheating of the collector. The tank temperature might continue to increase but only up to 203 °F (emergency shutdown of the tank).
In the evening the solar system continues running until the tank is cooled down to the adjusted maximum tank temperature via collector and pipes.

4.1.17 Tube collector special function

O TC:
Tube collector special function
Adjustment range: OFF...ON
Factory setting: OFF

If the controller measures an increase of 4°Ra compared to the last collector temperature stored, the solar pump is switched-on to 100 % for about 30 seconds. After the expiration of the solar pump runtime the current collector temperature is stored as a new reference value. If the measured temperature (new reference value) is again exceeded by 4°Ra, the solar pump again switches-on for 30 seconds. If the switch-on difference between collector and tank is again exceeded during the runtime of the solar pump or during standby mode of the system, the controller automatically switches over to solar charging.
If the collector temperature drops by 4°Ra during standby, the switch-on value for the special tube collector function will be recalculated.

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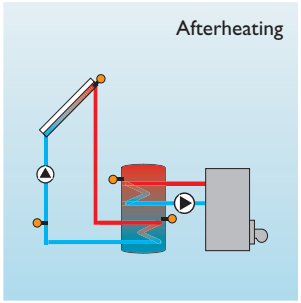
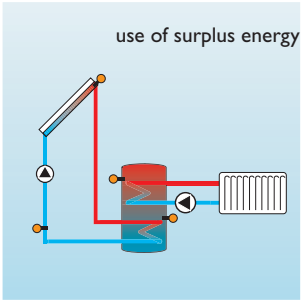
4.1.18 Thermostat function (Arr = 3)





The thermostat function works independently from the solar pump operation and can be used for after-heating by a boiler, use of surplus energy, or for rejecting excess heat.

- **AH O < AH F**
  the thermostat function is used for after-heating
- **AH O > AH F**
  the thermostat function is used for use of surplus energy or heat rejection.

The display shows the symbol ⓘ if the second relay output is activated.

AH O:
Thermostat-
switch-on temperature
Adjustment range 30...205°F
Factory setting 105°F

AH F:
Thermostat-
switch-off temperature
Adjustment range 30...205°F
Factory setting 115°F

t1 E, t2 E, t3 E:
Thermostat switch-on time
Adjustment range:
00:00 ...23:45
Factory setting: 00:00

t1 A, t2 A, t3 A:
Thermostat switch-off time
Adjustment range:
00:00 ...23:45
Factory setting: 00:00

In order to block the thermostat function for a certain time span, there are 3 time frames t1 ...t3. If the function should be activated only between e.g. 6:00 and 9:00, 6:00 should be set for **t1 E** and 9:00 should be set for **t1 A**. The factory setting for the thermostat function is in continuous operation.
If all time frames should stop at 00:00 o' clock, the thermostat function is continuously in operation (factory setting).

4.1.19 Operating mode

HND1/HND2:
Operating mode
Adjustment range:
OFF,AUTO,ON
Factory setting: AUTO

For control- and service works the operating mode of the controller can be manually adjusted by selecting the adjustment value MM in which the following adjustments can be made:

- **HND1 / HND2**
  Operating mode
  OFF : relay off ⚠ (blinking) + ✋
  AUTO : relay in automatic operation
  ON : relay on ⚠ (blinking) + ✋

4.1.20 Language

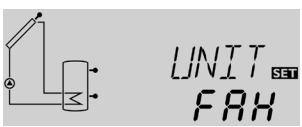
LANG:
Adjustment of language
Adjustment range: dE,En, It, Fr
Factory setting: En

The menu language can be adjusted in this channel.

- dE : German
- En : English
- It : Italiano
- Fr : French

4.1.21 Unit

UNIT:
Adjustment of unit
Adjustment range: FAH, °C
Factory setting: FAH



The menu unit can be adjusted:

- °FAH
- °CEL

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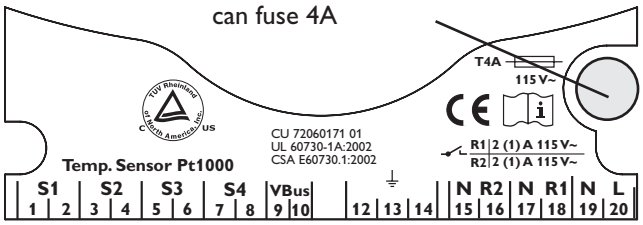
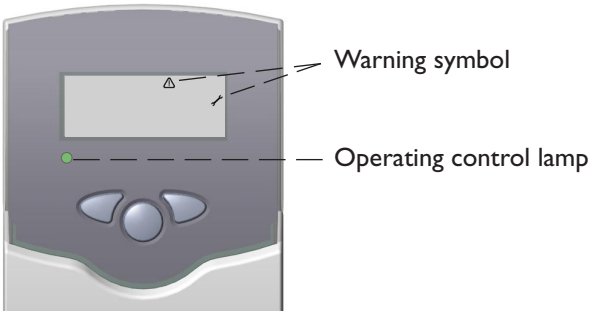
5. Tips for fault indication



If a malfunction occurs, it will be indicated on the display of the controller:



Operating control lamp flashes red. On the display the symbols and ⚠ appear.

Sensor defect. An error code is shown on the relevant sensor indication channel instead of a temperature.

888.8 — Line break. Check the line.

- 88.8 — Short-circuit. Check the line.

Pt1000-temperature sensors can be checked with an ohmmeter. The following table lists the corresponding resistance values for different temperatures.

°F	Ω	°F	Ω
14	961	131	1213
23	980	140	1232
32	1000	149	1252
41	1019	158	1271
50	1039	167	1290
59	1058	176	1309
68	1078	185	1328
77	1097	194	1347
86	1117	203	1366
95	1136	212	1385
104	1155	221	1404
113	1175	230	1423
122	1194	239	1442

Resistance values of the Pt1000-sensors

Operating control lamp off

Check the power supply

o.k. — The can fuse of the controller is defective. It can be replaced after removal of the front cover (spare fuse is enclosed in the accessory bag).

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5.1 Various:

Pump is overheated, but no heat is being transferred from collector to the tank, feed flow and return flow are equally warm, possibly also bubble in the tubes

- Air in the system?
  - no
  - yes → Exhaust the system; increase system pressure to the minimum pressures listed in the Vitosol Start-up and service manual. Switch the pump on and off for a short time
- Is the collector circuit blocked at the dirt trap?
  - yes → Clean the dirt trap

Pump starts for a short moment, switches-on/off repeatedly

- Is the temperature difference at the controller too small?
  - no
  - yes → Change ΔT_{on} and ΔT_{off} accordingly.
    - no
    - o.k.
- Wrong placing of the collector sensor?
  - no
  - yes → Mount the collector sensor at solar feed flow (warmest collector output); use the sensor well of the respective collector.
- Activate option tube collector special function

Pump starts up very late and stops working soon.

- Switch-on-temperature difference ΔT_{on} too large?
  - no
  - yes → Change ΔT_{on} and ΔT_{off} accordingly.
- Collector sensor unfavourable placed (e.g. contact sensor instead of sensor well.
  - yes → If necessary activate tube collector function.
    - o.k.

The temperature difference between tank and collector increases enormously during operation; the collector circuit cannot dissipate the heat.

- Collector circuit pump defect ?
  - no
  - yes → Repair / Replace
- Heat exchanger calcified?
  - no
  - yes → Decalification
- Heat exchanger plugged?
  - no
  - yes → Cleaning
- Heat exchanger too small?
  - yes → New calculation of the dimension.

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Tanks are cooled during the night.

Does collector circuit pump run during the night?
- no → Check the controller functions
- yes

Collector temperature is at night higher than ambient temperature.
- no → Check the supply and return line flow check valves to ensure functionality.
- yes

Is the tank insulation sufficient?
- yes
- no → Intensify the insulation.

Is the tank insulation close enough to the store?
- yes
- no → Replace or intensify the insulation.

Are the tank connections insulated?
- yes
- no → Insulate connections.

Warm water outflow upwards?
- no
- yes → Change connection and let the water flow sidewards or through a thermosiphon trap; less tank losses now?
  - no
  - yes → o.k.

Does warm water re-circulation pump run for a very long time?
- no
- yes → Use the re-circulation pump with timer and switch-off thermostat (energy efficient circulation)

Switch-off the re-circulation pump and the isolation valve for 1 night; less tank losses?
- yes → a
- no → Check the pumps of the after-heating circuit according to nightly run and defective check valve; problem solved?
  - no → b

a

Control the check valve in warm water circulation- o.k.
- yes → The gravitation circulation in the circulation line is too strong; insert a stronger check valve or an electrical 2-way valve behind the circulation pump; the 2-way valve is open in pump operation, otherwise it is closed, conect pump and 2-way valve in parallel; activate the circulation again!
- no → Cleaning or replacement.

b

Please also check further pumps which are connected to the solar tank.

The solar circuit pump does not work although the collector is obviously warmer than the tank.

Does the control LED flash?
- yes
- no → There is no current; check fuses / replace them and check power supply.

Does the pump start up in manual operation?
- no
- yes → The adjusted temperature difference for starting the pump is too high; choose a matching setting

Is the power supply to the pump coming from the controller?
- no
- yes → Is the pump stuck?
  - yes → Put the pump into operation by means of a screwdriver; is it passable now ?
    - no → Is the pump out of order? - replace if necessary

Are the fuses o.k.?
- no → Replace the fuses.
- yes → Controller seems to be defective - replace it.

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6. Accessory

Smart Display SD3

Serves as a visualization of collector and DHW tank temperature, as well as energy transfer (kWh) within the solar system.

Datalogger DL2

Come complete with ServiceCenter Software (full version). Compact wall mounted devise to capture system operational details enabling further anaylsis using ServiceCenter software, or using spreadsheet software. Comes with 180 MB flash memory and ethernet cable connection.

ServiceCenter Light Software c/w USB Adaptor Cable

Used to view system activities and performance in real time obtained from the Solar Control Unit and it's sensors.

ServiceCenter Full Software c/w USB Adaptor Cable

Same as above plus datalogger integration and ability to change settings of Solar Control Unit using PC.

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